

Section of the book "The Memorial History of
Louisville: From Its Settlement to the Year 1898"

(128)

CHAPTER XXIX.

THE LOUISVILLE WATER WORKS.

BY CHARLES HERMANY.

The Louisville Water Company was incorporated by the General Assembly of the Commonwealth of Kentucky through an act passed March 6, 1854. The incorporators were: Thomas E. Wilson, Bland Ballard, John R. Hamilton, Chas. J. Clarke, Andrew Graham and Curran Pope. By this act it was provided, among other things, that the works were to be completed on or before March 6, 1857.

On March 3, 1856, this act was amended so as to fix the date of completion January 1, 1859.

The time thus fixed for completing the works having expired without completing them, the charter was "renewed and amended so as to allow said company such other and further time as said company may require to complete the works," by an act of the General Assembly of the Commonwealth of Kentucky approved January 20, 1860.

A third amendment to the charter was made by an act of the General Assembly of the Commonwealth of Kentucky approved February 28, 1867, by which the water company was authorized to increase its capital stock fifteen thousand shares, in addition to the stock authorized to be subscribed by the act of March 6, 1854, and the city of Louisville to subscribe for said stock or any part thereof.

A fourth amendment to the charter was made by an act of the General Assembly of the Commonwealth of Kentucky approved March 22, 1871, by which the directors and officers of the water company were exempted from service as grand or petit jurors in or for the County of Jefferson.

An act for the benefit of the Louisville Water Company by the General Assembly of the Commonwealth of Kentucky approved March 27, 1880, provided for the adoption, publishing and enforcement of rules and regulations, the collection of fines for unauthorized use of water, the appointment of persons vested with the power of policemen, of the city of Louisville or Jefferson County, the borrowing

of money, and the payment of taxes, more specifically than defined in the original charter or in the amendments thereto.

A fifth amendment to the charter was made by an act of the General Assembly of the Commonwealth of Kentucky, approved April 22, 1882, which made it the duty of the water company to furnish water to the public fire cisterns and fire plugs or hydrants of the city of Louisville for fire protection free of charge, and exempted said water company from the payment of taxes of all kinds.

A sixth amendment to the charter was made by an act of the General Assembly of the Commonwealth of Kentucky, which became a law May 9, 1890, which authorized the water company to borrow \$500,000, or issue a second mortgage for that amount, for the purpose of repairing the losses sustained by the tornado of March 27, 1890, and for laying an additional water main from Crescent Hill reservoir into the city of Louisville, not to exceed forty-eight inches in diameter, and for enlargement of mains in the city of Louisville.

To September 9, 1856, private subscriptions amounted to \$5,100, and that of the city of Louisville to \$550,000.

The city's subscription was made in conformity with an ordinance passed by the General Council of the city of Louisville on January 30, 1856, which ordinance was not to take effect until after having been submitted to the qualified voters of the city of Louisville, and approved by a majority of those voting thereon, as prescribed in the city charter.

At a special popular election held September 6, 1856, the following vote was polled, viz.:

For subscription.....	1,415
Against subscription.....	370
Majority for subscription.....	1,045

Shirley Botkin's

The city's stock subscription was further conditioned by an ordinance approved June 30th, 1856, section 6th of which reads as follows, viz.: "The subscription herein authorized to be made is to be upon the express condition only that said water company will execute a covenant to the city of Louisville, binding said company not to accept, after the subscription herein authorized to be made, of any further subscription to its capital stock, except by agreement on the part of the persons taking stock, that the city may, at any time, purchase said stock by paying the holder the money advanced by him, and ten per centum per annum interest thereon from the time of payment; the dividends which may be received by said stockholder to be estimated as part of such per cent," which covenant was executed by the water company October 20th, 1856.

On July 8th, 1859, the city of Louisville made a further subscription to the stock in the Louisville Water Company of \$220,000, which subscription was made in conformity with an ordinance passed by the General Council of the city of Louisville on January 14th, 1859, which ordinance was also "not to take effect until it shall have been submitted to the qualified voters of the city of Louisville, and approved by a majority of those voting thereon, as prescribed in the city charter."

At a special popular election held April 2d, 1859, the following vote was polled, viz:

For the ordinance.....	2,617
Against the ordinance.....	433
Majority for the ordinance.....	2,184

On August 1st, 1867, the city of Louisville made a third subscription to the stock in the Louisville Water Company which amounted to \$500,000.

Which third and last subscription was made in compliance with a resolution by the General Council of Louisville, approved June 18th, 1867, "under and by authority of an act of the General Assembly of the Commonwealth of Kentucky, approved 28th of February, 1867."

SUMMARY OF STOCK SUBSCRIPTION.

September 6th, 1856, private subscription..	\$ 5,100
September, 6th, 1856, city of Louisville..	550,000
July 8th, 1859, city of Louisville.....	220,000
August 1st, 1867, city of Louisville.....	500,000
Total	\$1,275,100

The first bonds issued were city of Louisville water bonds, authorized by an ordinance approved June 30th, 1856. They amounted to

Bonds. six hundred and seventy-two one thousand dollar thirty year six per cent bonds, with semi-annual interest coupons attached, which bonds the city of Louisville gave the water company in payment for five thousand five hundred shares of stock in said company. These bonds were dated May 1st, 1857. These bonds were paid and destroyed by the sinking fund of Louisville before and at maturity.

The second bonds issued were city of Louisville water bonds, authorized by an ordinance approved January 14th, 1859, which aggregated two hundred and eighty-four one thousand dollar thirty year six per cent bonds, with semi-annual interest coupons attached. These bonds were given by the city of Louisville to the water company in payment of two thousand two hundred shares of stock in said company. These bonds were dated May 1st, 1859, and were paid and destroyed by the sinking fund of Louisville before and at maturity.

The third bonds issued were water company bonds, dated February 1st, 1863. The amount issued was two hundred one thousand dollar twenty year six per cent bonds, with semi-annual interest coupons attached. These bonds were paid and destroyed by the water company before maturity.

The fourth bonds issued were city of Louisville water bonds, aggregating five hundred one thousand dollar thirty year six per cent bonds, with semi-annual interest coupons attached. These bonds were issued by resolution of the General Council of the city of Louisville, approved June 18th, 1867, authorized by an act of the General Assembly of the Commonwealth of Kentucky, approved February 28th, 1867, and given to the water company in payment of five hundred shares of the capital stock of said company. One bond of this lot has been paid and destroyed by the sinking fund of Louisville.

The fifth issue of bonds was water company bonds, dated October 2d, 1876, and amounted to nine hundred one thousand dollar thirty year six per cent bonds, with semi-annual interest coupons attached.

Sixty of these bonds have been paid and destroyed, three paid and canceled, and the remainder's retirement at maturity provided for by an ample sinking fund of the water company's creation and maintenance.

The sixth issue of bonds was water company

bonds dated August 1st, 1890, and amounted to five hundred one thousand dollar twenty year five per cent bonds, with semi-annual interest coupons attached. The payment and retirement of these bonds at maturity is provided for by an ample sinking fund of the water company's creation and maintenance.

The administration of the affairs of the water company is vested in a board of six directors, whose term of office is three years, two new directors being elected each year on the first Monday in October. They are elected by the stockholders—the sinking fund of the city of Louisville.

The men who have filled the office of directors are here named in alphabetical order with the years in and during which they served:

Adams, Ben J.	1859 to 1862
Ainslie, Geo.	1863 to 1866
Ainslie, Geo.	1874 to 1877
Alexander, R. B.	1873 to 1880
Benedict, D. S.	1856 to 1871
Beatty, D. L.	1856 to 1860
Beatty, D. L.	1863 to 1866
Badger, A. C.	1856 to 1857
Belknap, W. B.	1863 to 1874
Baxter, J. G.	1864 to
Barret, W. F.	1868 to 1869
Bradley, James	1871 to 1883
Burnett, T. L.	1878 to date
Barret, J. S.	1891 to date
Coleman, T. C.	1856 to 1857
Curd, H. T.	1856 to 1859
Du Pont, B.	1870 to
Faulds, D. P.	1870 to 1873
Gilbert, J. C.	1883 to date
Griffiths, Geo. W.	1888 to 1891
Harris, Alfred	1857 to 1861
Inman, Wm.	1856 to 1857
Inman, Wm.	1859 to 1863
Kalfus, Jacob W.	1861 to 1864
Lithgow, J. S.	1858 to 1860
Long, Dennis	1865 to 1867
Long, Chas. R.	1880 to date
Monohan, J. M.	1862 to
Moore, J. T.	1872 to 1873
Reed, L. S.	1885 to 1888
Shotwell, A. L.	1857 to 1862
Smith, Jno. B.	1865 to 1888
Story, Jno. W.	1866 to 1890
Smith, W. W.	1875 to date
Stoll, A. B.	1890 to date
Tompkins, J. T.	1866 to 1875

The men who have held the office of President are here named in the order of their respective terms of office, viz.:

Hon. Alfred Harris	1856 to 1864
Hon. Wm. F. Barret	1864 to 1874
Hon. Charles R. Long	1874 to date

The office of Secretary and Treasurer combined was filled by Hayden T. Curd from December 26th, 1856, to November 29th, 1858, 1 year and 11 months.

Francis Macguire, from November 29th, 1858, to July 2d, 1859, 7 months.

G. R. Hunt, from July 2d, 1859, to May 5th, 1864, 4 years and 10 months.

C. J. Kent, from May 5th, 1864, to December 21st, 1867, 3 years and 8 months.

W. H. Henderson, from January 1st, 1868, to April 10th, 1871, 3 years and 3 months.

At this time the office of Secretary and Treasurer was separated into two and an officer for each elected.

That of Treasurer was filled by Wm. P. McDowell from April 10th, 1871, to January 1st, 1892, 20 years and 9 months.

Wm. F. Ingram, from January 1st, 1892, to date.

The office of Secretary was filled by W. I. Gilliss from April 24th, 1871, to June 4th, 1872, 1 year and 1 1-3 months. Mr. Gillis died in office.

R. H. Waggener, from June 24th, 1872, to October 2d, 1876, 3 years and 9 months.

George Cressey, from October 2d, 1876, to May 1st, 1882, 5 years and 7 months.

J. B. Collins, from May 1st, 1882, to date.

The office of Chief Engineer of Construction was filled by Theo. R. Scowden from December 3d, 1856, to January 1st, 1861, 4 years and 1 month.

The office of Chief Engineer and Superintendent by Charles Hermany from January 1st, 1861, to date.

In the cosmös of the ancient philosophers water was one of the four simple elements. If in the pres-

Utilization of Water.

ent day we so regard it, we find that in its fluid and congealed states it constitutes more than three-fourths of the earth's surface, about 1-325 its volume and about 1-1786 its weight, to say nothing of it as a constituent part of many of the solids which make up the greater bulk of our globe.

Considered in connection with our atmosphere and the heat from the sun, water appears as a grand circulating system, which elevates our planet from its hitherto generally described power environed or gravity constrained projectile to the rank of an organized body, which possesses its full share of the

marvels which enrich and embellish that grand cosmos, which man is striving to decipher and is destined finally to comprehend.

If our planet has been demonstrated to rank as an organized body, the fact is plainly predicated upon its existence as life involved, which antedates that which we call the vegetable and animal kingdoms, which latter seem, in their eventual full development, to complete its mission as a modest, but royally accredited member, in the majestic assemblies of the universe.

As an indispensable constituent of our planet, water, in the glacial period, ground the earth into habitable form and productive consistency, now fosters commerce and the blessings resulting from an interchange of civilization's peace products, and also floats vast navies which tend to balance the self-preserving forces of the nations. So great is this heritage of nature that dominion over the vast oceans has been coveted by many nations, ancient and modern, but accorded to none, for of nature's estate, man universal, though still weak and shortsighted, is nevertheless the Creator's appointed administrator. As man universal shall grow in this highest executive function, and learn to bring about the realization of the ever present and living hope of an eventual millennium; as he progresses in his appointed career and develops the continent embracing drama, the world expounding story shall become household words, the choicest of which will be water, repeated as fervently in the annals of the poor as self complacently in the chronicles of the rich.

But it is not so much in a cosmic sense—a humanity embracing heritage—or the special life sustaining medium of this planet, as in the more restricted field of individual, family, communal and municipal service, that we here write about water and the methods of its utilization.

Co-important with the air we breathe as an element in life is the water we drink. In rural life where the conditions are favorable to health the natural supply of both these elements generally suffices for the use of man. The country air is pure and healthful, and good water is derived either from natural springs or those artificially reached by wells. Little thought or expense is required to meet the demands of the family and insure good hygienic conditions. But when population thickens and begins to form towns and cities the problem of a supply of pure air and water increases in proportion to its number or density.

The atmosphere loses its freshness and purity, be-

comes contaminated by smoke and exhalations, the waste and decay of perishable refuse, and the preservation of health by thorough hygienic police, the drainage of surface water, the construction of sewers, and other well-appointed regulations to prevent the contamination of the air we breathe become matters of the greatest importance for the preservation of the health of the community and for the prevention of the spread of epidemics and infectious diseases. In the same way the problem of a healthful water supply rapidly assumes gravity as the population advances from a single family to a hamlet, a town or a city. The springs and wells soon become inadequate; the supply from the spring and well becomes in time impure as part of the vehicle of the city's drainage and a source of water supply must be sought free from the contamination of local causes and protected in its transportation from possible infection. Hence the attention of men in civilized communities was early directed to supplying pure water for drinking and for domestic uses, and this was done long before the subject of atmospheric purity, drainage or other hygienic devices were considered or deemed necessary.

Next to the pyramids and their great temples the ancients expended more labor and expense upon their aqueducts for conveying an abundant supply of pure water for their cities than for any other object.

Ancient Water Works.

Rome particularly was conspicuous in this department, the modern supply of the eternal city being still conveyed in conduits which date back to the Caesars, the system including fountains for ornament as well as for drinking purposes, together with free baths for the people. The provinces copied after the metropolis, and the ancient aqueducts of France and Spain are among the finest specimens of masonry structures in existence, water being conducted across wide valleys upon arches of cut stone as notable for their fine mechanical structure as for their still excellent state of preservation. The Spanish carried their system to Mexico, and in Chihuahua and other cities are to be seen reproductions of the Roman aqueducts, which convey water from mountain springs to cities built on arid plains.

Rome was supplied with fourteen aqueducts, the longest of which was sixty-two miles, partly above and partly beneath the ground. At one place approaching the city it was conveyed for several miles upon a chain of arches 109 feet in height. This, however, is inferior in height to the Pont du Gard near Nismes in France, erected in the time of Augus-

tus, which crossed a valley at an elevation of 180 feet. The aqueducts in Greece were more ancient but quite as remarkable for the skill shown in their construction, some of them being still in use.

The use of aqueducts for conveying water across streams or valleys and preserving a nearly horizontal grade, was not because the ancients were ignorant of the law of hydrostatics, which causes water to seek its level and thus admits of its being conducted in pipes across depressions, and again rising to its original height. They understood this law and applied it in the use of small leaden pipes. But not having pipe of iron or other cheap and abundant material strong enough to withstand great pressure or to convey water in large volumes they had to resort to the use of masonry aqueducts where there was great inequality of line profile. The arches are used for greater strength and economy of material as well as to prevent obstruction to travel and to admit the free passage of water from rainfall.

Within the last century the invention and improvement in the manufacture of cast iron and sheet metal pipe has resulted in the almost general substitution of iron pipes for the stone conduits and done away with the necessity of elevated aqueducts. Nor is the masonry aqueduct entirely dispensed with since the introduction of cast iron pipes; some considerations in exceptional cases lead engineers to adhere to conduits conveyed upon them. A notable instance of this is in the Croton Water Works, New York, where the water is conveyed over the Harlem Valley in iron pipes laid upon a magnificent stone bridge 1,460 feet long and 114 feet high. The canal or conduit which supplies Marseilles, France, is carried over the ravine of the River Arc upon the Aqueduct Roquefavour, a modern structure 262 feet in height and 1,287 feet in length. All of these plans which utilize the conduit, whether constructed on the solid earth or upon an aqueduct, are for the purpose of conveying the water of springs or mountain streams for the use of people congregated in cities.

Scarcely less remarkable than the Roman devices for water supply are those of India, which probably antedated the European system, and are still in use. They consist of large artificial lakes and tanks for the storage of water in the vicinity of their temples and palaces; with an arid country of level topography, and with no pure streams from which to draw a supply of water, they adopted the plan of building large storage reservoirs in which to collect a supply of rain water during the periodical rainy seasons for use during the dry seasons.

This system has been adopted in all countries where the conditions are favorable, is known as the catchment reservoir system, and may be considered as the most primitive system of artificial water supply for public use.

In its crudest form the result is effected by throwing a dam across a running stream or across a dry valley for storing the rainfall and, where the storage supply is higher than the town or city to be served, the water is conveyed in pipes by gravity and distributed by natural pressure.

When the storage reservoir is too low to admit of this, the water is pumped either directly into the mains or into a stand-pipe or elevated distributing reservoir and thence into the mains by gravity. This is the most common form of modern water supply. The only objection to it is that however pure the water may be when freshly caught, being confined as still water without circulation, it sometimes becomes pond water without regard to the acreage of the reservoir. Its purity is liable to deterioration from this stagnation according to the organic matter with which it may become impregnated from the forests, fields or pastures composing the watershed.

The catchment and impounding reservoir system by which Boston, New York and Baltimore are supplied is the largest of this class of waterworks in the United States, and in which during ordinary seasons the natural supply of water is sufficient to prevent the danger resulting from stagnation. When there is a deficiency of rainfall, followed by a hot summer, serious inconvenience has been experienced from this cause. The recent enlargement of the reservoirs, extension of the watershed, removal from it of habitations and other sources of impurity of the Croton system, have improved the conditions and lessened the dangers which must, however, recur with the growth of population and the increased consumption of water.

Even the great lakes are not exempt from the objections which attach to the catchment reservoir system of which they present examples on the largest scale. The outflow at Niagara and the agitation of the winds and storms would seem to insure a thoroughly aerated and healthful water. This would be true if the water were not liable to contamination from the sewage of cities which draw their supply from that source. But, unfortunately, the lake itself receives the drainage of the city, which is poured into it generally from a small river into which the city sewers empty, and which becomes in summer a most

impure and offensive stream. Once emptied into the lake it is a matter of chance as to whether it will not be borne by the waves caused by prevailing winds to the cribs where are anchored the mouths of the intake pipes, whence the waterworks secure the supply for the city. At such times, especially in summer, the water furnished the people must be contaminated with sewage, a condition common to nearly all the cities on the lakes, and so fully realized that there has sprung up in some of them a large traffic in water conveyed from a distance inland by rail, in jugs and tanks, and supplied to customers who seek thus to avoid possible contagion.

So serious has this danger from sewage become in Chicago, that after vainly seeking to remedy it by extending their supply pipes farther and farther into the lake, a great drainage canal, over thirty miles in length, is now being dug at a cost of more than twenty million dollars, which will convey the sewage of the city with water from the lake to the Illinois river, finding an outlet in the Mississippi, and in thus promoting the health of one city it menaces that of others.

The source of water supply for cities deemed most healthful and free from the objections noted is from a running stream having its sources in mountains of a freestone formation, since this more nearly approximates in purity and softness to pure rain water.

Water from springs or wells in a limestone formation or from a stream surcharged with lime, while palatable and relished by many, is too hard, as it is termed, for domestic purposes, the lime in solution impairing its detergent properties and forming in combination with soap a precipitate which makes it unpleasant for ablution or the laundry. Fortunately almost all our large rivers are free from this objection. The tributaries of the Ohio, Mississippi, Missouri and other large rivers have their sources in other than limestone formations. The Ohio River is especially favored in this respect, its water being, when in a natural condition, soft and free from deleterious impurities. Its current even at the lowest stages of summer forbids stagnation and with the oxygenating power of the air and sun, soon eliminates from it organic matter derived from drainage it receives along its course. It is from this source that Louisville receives her water supply.

In the city's early history its people drank first from springs which flowed from the banks into the river, and then from wells dug in the alluvial soil which at a depth of thirty or forty feet afforded an

abundant supply. As the town increased in population much of the sickness with which it was afflicted was attributed to this impure water, and various plans were suggested for remedying the evil. Among others, that of Dr. H. McMurtrie may be quoted from his "Sketches of Louisville and Its Environs in 1819," as one of the earliest. He says:

"The well water of Louisville which is found at various depths, from sixteen to forty feet, and which is that commonly used by the inhabitants, is extremely bad, containing besides a considerable quantity of lime, a large portion of decomposed vegetable matter. The springs which break out near the river are generally considered unwholesome, whereas if there be any truth in chemical analysis the fact is precisely the reverse. The water of the wells, after standing a little while, becomes nauseous to the taste and acquires a smell highly disagreeable to delicate stomachs; that of the springs, at least of the one I have examined, contains no lime or foreign matter, is pleasant to the taste, and is perfectly inodorous, its specific gravity being so near that of distilled water that no difference could be perceived between them in several experiments instituted for that purpose wherein were used a very accurate and delicate pair of balances.

"This bad quality of the water in general use is one cause of a variety of complaints, particularly diarrhoea, that are so common in the summer months, and calls loudly for a remedy which may be easily found in a steam engine, and the Ohio, whose waters being extremely pure, might with a little expense, be distributed through every part of the town, an arrangement which will probably take place at no very distant period."

A notable point in the last paragraph of this quotation is the vaguely expressed but bold conception of Dr. McMurtrie's of a system of direct pressure water supply for cities, in which he indorses—unwittingly, perhaps—the famous series of tide water wheel pumps under the arches of London bridge, the first of which series was constructed in 1581, during Queen Elizabeth's reign, by Peter Morice, under a lease granted him for a period of 500 years. This effort proving a success, the lease, two years afterward, was extended for the use of the second arch for a like number of years. These works were extended to embrace three arches of the bridge and remained in the possession of Morice and his family during 120 years, were afterward sold, enlarged, op-

Most Healthful
Water Supply.

Louisville Well
Water.

Direct Pressure
Water Systems.

erated during an additional 121 years, and finally destroyed by the construction of the new London bridge. At the time of their destruction the works occupied six of the twenty arches of the bridge and delivered more than 5,000,000 gallons daily.

This was the first public direct pressure system of water supply of which history makes mention. But the Doctor little estimated the many obstacles to be surmounted from the beginning of Peter Morice in England to the ending of Birdsill Holly in America in order to make a system of direct pressure reliable for an uninterrupted and ample supply to a large city using many miles of pipe and thousands of water fixtures, in, through, and by all which are produced great variations in velocity and pressure and sometimes destructive water hammer in the distributing system.

During the past fifty years the design and construction of machinery and devices necessary for making this concept effective and reliable has engaged the highest constructive talent and required the expenditure of millions of dollars. Notwithstanding all this, however, the concept of the Doctor has been wrought into a degree of excellence and efficiency in the many colossal systems in successful operation, which, could he now survey them, would both startle and delight him as examples of the evolution of his concept.

The direct pressure system of public water supplies thus perfected has been adopted by many towns and cities in our country, and has frequently met the requirements at a greatly lower cost than was practicable by any of the previously devised systems. The governing principle embodied in this system is simply one of perfect adaptation of means to ends, of which a fair illustration may be witnessed in an extensive assemblage of steam boilers being energetically fired and properly supplied with water by means of a feed pump.

The abiding faith expressed by Dr. McMurtrie in the wholesomeness of the Ohio River water has been justified by the long continued use made of it by the people of Louisville in spite of the many efforts at impeachment made by sensational, pessimistic and perhaps time-serving scribes, who flourish their phylacteries before the public as did the Pharisees of old. That the river water is not pure is popularly known, but that it is unwholesome or that it has been the cause of sickness and death among the people using it has not been demonstrated, and is an open question, the satisfactory determination of which must be taken from the realm of dis-

tempered imaginations and relegated to that of science.

Intermediate between the systems of catch-water or impounding reservoirs and that of direct pumping is the system of pumping by water or steam power actuated machinery, from rivers or other bodies of water into elevated reservoirs, whence the water is distributed by gravity through systems of main and distributing water pipes, of which intermediate system the Louisville waterworks were originally an example, but they have, in the course of time, been so modified as to be made at will a combination of the intermediate system with that of pumping direct.

The time at which the intermediate system, between gravitation and direct pumping, came into general use is not determinable without much investigation but may be safely assumed as coincident with the improvement in steam pumping machinery, through which this combination of pumping engines and reservoirs has been extended so as to exceed in volume of supply and distribution all others combined in the United States.

The first decisive steps toward establishing a public water supply for Louisville were taken in the fall of 1856 by a committee from the then recently elected Board of Directors in the Louisville Water Company, who visited the principal works then in operation in the cities of the Middle and Eastern States, as a means of adopting measures and plans that would bring together for the erection of the contemplated works the best judgment and ripest experiences that the numerous important works in the country then exhibited.

During December of 1856 and January, February and March of 1857, surveys were made, sites for pumping station and reservoir selected, plans of the various branches of the works with estimates of cost were made; all of which were duly adopted and contracts let for making pipe, building pumping station, reservoir, and pumping engines. Ground was broken upon the reservoir site in a primeval beech forest in March, 1857, and upon the construction of the pumping station on the banks of the Ohio River in the following September, and quite a large quantity of pipe was made during this season.

Owing to the financial panic of this year, however, very little was done in the way of actual construction, the failure of the Ohio Life and Trust Company of Cincinnati having precipitated a financial disturbance which greatly embarrassed all kinds of business

enterprises for this and the greater part of the following season.

In March, 1858, work was resumed and pushed energetically until October, 1860, when the works were so far completed as to enable the water to be turned into the city distributing pipes. In the succeeding year the works were completed.

The result of this undertaking was a pumping station and machinery which served the city for thirty-three years, a reservoir of ten million gallons' capacity, which sufficed for nineteen years, and the beginning of a system of supply and distributing pipes which aggregated twenty-six miles at that time.

All was accomplished by the expenditure of \$837,680.07 in cash, and a stock liability of \$775,100 up to January 1st, 1862.

In 1874 surveys were commenced for a new reservoir (at Crescent Hill) of larger capacity and greater elevation above the level of the city. A site was selected, plans made and adopted, and the work contracted for in the fall of 1876, all for a reservoir of 100,000,000 gallons' capacity, with its top water level 179 feet above low water in the river, being thirty-three higher than that in the reservoir completed in 1860. In April, 1877, active work was commenced upon the construction of this reservoir and continuously and energetically prosecuted until December 15th, 1879, when it was nearly completed, water first pumped into it, and the city thenceforward supplied with water therefrom.

In the latter part of 1885 (the utmost capacity for supply from the 1860 station having been almost equaled by the consumption of water) work was commenced upon the construction of a new pumping station by building an artificial earthen embankment located contiguous to and downstream from the first station, upon which to erect boiler-house, chimney, coal houses and such other structures as pertain to a waterworks pumping station. This embankment was completed in June, 1886, and thence to June, 1888, had two years' time for settlement. In the last named month and year work was commenced upon all parts of the new station and prosecuted continuously until completed in July 1st, 1893, as appears by the following extract from the thirty-sixth annual report of the water company:

"This comprises a station separate from Station No. 1, and consists of two intake pipes from the river into two separate wells in the new house; a house with foundations for two separate pumping

Equipment.

engines; a bridge connecting the house with the river bank; an embankment 220 by 240 feet in plan at top of level, built eight feet higher than the flood of 1884, upon which embankment has been erected a boiler-house of sufficient size to set boilers for two pumping engines, with one chimney to furnish draught for all. One engine and boilers only have been built, with a short thirty-six-inch delivery pipe connecting with the two thirty-inch pump mains, leading from Station No. 1 to the reservoir. It was brought sufficiently near to completion on July 1, 1893, to put it into regular service. Accordingly, on said day, pumping engine No. 3 was put into service, having been first tried on May 15th, and run occasionally from that day on as the work of completion progressed."

Thenceforward to date the city has been supplied almost wholly from this station. The station completed in 1860 has not, however, been abandoned, but is in perfectly efficient working order, and occasionally operated as a means of having it in prompt availability should need arise for its service.

The machinery at the 1860 station consists of two beam Cornish engines, duplicates, of a nominal capacity of seven and a half million gallons each per twenty-four hours, and two pair of duplex steam pumps of a nominal capacity of six million gallons per twenty-four hours, with two batteries of boilers containing each three Cornish boilers. These four pumping engines with six boilers can be operated safely while delivering water at the rate of sixteen million gallons per twenty-four hours.

The new station has one compound beam and fly-wheel engine with three Belpaire fire-box boilers. The nominal capacity of this engine is sixteen million gallons per twenty-four hours, is now generally pumping at the rate of eighteen million gallons, and believed to be entirely safe for pumping at the rate of twenty million gallons per twenty-four hours.

The pumping stations contain pumping machinery enough to pump safely at the rate of thirty-six million gallons per twenty-four hours. They are located on the left bank of the Ohio River above the City of Louisville four and a half miles distant from the City Hall. The water is taken from the river, where in the past there has not been, where there is not now, nor is likely to be in the near future, any local cause for contaminating the water pumped. Where the river is a broad, deep and live stream, straight for stretches of three miles each way from the stations, exposed to the light of the sun and all prevailing winds, where it has a clean gravel bed,

and where all desirable conditions for safe and satisfactory intakes are found combined to an unusual degree of completeness.

In connection with the station of 1860 there is a stand-pipe, which was erected at the beginning. It was a single pipe, four feet in diameter, and served as a relief to the single-acting pumps of the Cornish engines. In 1875 this pipe was modified in its construction details so as to make it an overflow pipe, in which latter condition it relieves the pump mains and distributing system of pipes entirely from the pulsations or variations in pressure produced when pumping direct, as has been frequently done since the change in its construction was made.

From the 1860 pumping station to Crescent Hill reservoir, a distance of two and a quarter miles, there are laid two lines of thirty-inch pump mains, through which there have been at times as much as twenty-five million gallons of water per twenty-four hours delivered into the said reservoir. At a point 3,100 feet distant from the station these lines of pipe have two branches of like diameter extending west to the reservoir of 1860, are connected therewith, and also to the original twenty-inch and subsequent thirty-inch supply mains conveying the water from said reservoir to the city, by which branches and connections pumping direct into the city distribution has been done frequently during the past twenty-one years.

From the new pumping station there has been laid a line of thirty-six inch delivery pipe for a distance of 719 feet, where it is connected with the two lines of thirty-inch pipe above described and from which point said line of thirty-six inch pipe is at present being laid to Crescent Hill reservoir.

From Crescent Hill reservoir to the city there have been laid two lines of supply mains, one thirty-six and the other forty-eight inches in diameter, the latter being over six miles in length.

The entire system of pipes comprises 198 miles, varying in diameter from 48 to 3 inches.

The subject of supplying the city with clear water has long been a question of study and discussion, as will appear from an examination of the annual reports of the water company as far back as the year 1866, but the great cost of constructing and operating filters to clarify successfully the water from a river which has as many tributaries as the Ohio, which

drains districts geologically widely different, as also the refuse from populations of varying industrial pursuits, presenting water of constantly and greatly varying quality, constitutes a problem of great complexity, which has hitherto prevented steps being taken for its practical solution.

The now commonly accepted theory of the transmission of certain diseases through germs conveyed into the human system by drinking water has caused an extraordinary impetus to be given to the work of water purification for public supplies in England and on the continent of Europe. In the United States of America this line of public service has not been so fully developed, but it is under fair headway, and will not be arrested materially in its rapid progression, no matter what physical difficulties will have to be encountered or what the cost may eventually be.

The popular mind is apparently thoroughly imbued with the great importance of the subject, and will, probably not longer, murmur at the pecuniary burden involved in obtaining better water. The popular understanding of a menace to health and life brings into play the great law of self-preservation in exact proportion to the extent to which the danger is comprehended, increased somewhat, perhaps, by the pendulum-like sway which often characterizes human progress.

The physical laws which underlie and control practical purification of water (simply to a degree which makes it wholesome) have been the subject of much study and experiment. The theoretic and learned but slow-paced and spectacles encumbered scientists are trudging at one end of the line, the energetic and money-loving but limping and patent-mongering all-round men are wabbling at the other, each party approaching the other, in all which there is implied a common ground upon which they will eventually meet in success and peace, each side claiming that they got there first—it so ends in the accomplishment of all great improvements.

Perceiving the shadow of events to come, the Louisville Water Company has instituted a series of experiments in water purification in a manner and for a period of time that it is hoped will discover what can be done to clarify and purify the Ohio River water and what it will cost to do it upon a scale of magnitude that will meet the needs of the city.

Experiments with
Filters.